5-YEAR REVIEW

Short Form Summary

Species Reviewed: *Cyrtandra viridiflora* (haʻiwale)

Current Classification: Endangered

Federal Register Notice announcing initiation of this review:

[USFWS] U.S. Fish and Wildlife Service. 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

Lead Region/Field Office:

Region 1/Pacific Islands Fish and Wildlife Office (PIFWO), Honolulu, Hawaiʻi

Name of Reviewer:

Cheryl Phillipson, Biologist, PIFWO
Lauren Weisenberger, Plant Recovery Coordinator, PIFWO
Megan Laut, Conservation & Restoration Team Manager, PIFWO

Methodology used to complete this 5-year review:

This review was conducted by staff of the Pacific Islands Fish and Wildlife Office (PIFWO) of the U.S. Fish and Wildlife Service (Service) beginning in October 2018. The review was based on a review of current, available information since the last 5-year review for *Cyrtandra viridiflora* (USFWS 2013). The evaluation completed by Cheryl Phillipson, Biologist, was reviewed by Lauren Weisenberger, Plant Recovery Coordinator, and Megan Laut, Conservation and Restoration Team Manager.

Background:

For information regarding the species' listing history and other facts, please refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (*http://ecos.fws.gov/tess_public*).

Review Analysis:

Please refer to the previous 5-year reviews for *Cyrtandra viridiflora* published in the Federal Register on April 8, 2009 and August 1, 2013 (available at *https://ecos.fws.gov/docs/five_year_review/doc2465.pdf* and *https://ecos.fws.gov/docs/five_year_review/doc4209.pdf*) for a complete review of the species' status, threats, and management efforts. We are not aware of any significant new information regarding the species' biological status since listing to warrant a change in the Federal listing status of *C. viridiflora*.

This short-lived perennial small shrub in the Gesneriaceae (African violet) family is endangered and endemic to Oʻahu. The current status and trends for *Cyrtandra viridiflora* are provided in the tables below.

New Status Information:

- Currently, there are 59 to 63 individuals of *Cyrtandra viridiflora* in seven populations in the Koʻolau mountains. Most locations have not been monitored within the last five years (U.S. Army 2018). This is a decline in numbers since the last 5-year review in 2013 (70 individuals).
- In 2012, 14 critical habitat units in two ecosystems (lowland wet and wet cliff) were designated for *Cyrtandra viridiflora* in the Koʻolau mountains of Oʻahu (30,058 ac, 12,162 ha) (77 FR 57648, September 18, USFWS 2012).

New Threats:

- Climate change loss or degradation of habitat—Climate change may pose a threat to this species. Fortini *et al.* (2013) conducted a landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi using high resolution climate change projections. Climate change vulnerability is defined as the relative inability of a species to display the possible responses necessary for persistence under climate change. The assessment by Fortini *et al.* (2013) concluded that (at the species level) *Cyrtandra viridiflora* is extremely vulnerable to the impacts of climate change, with a vulnerability score of 0.973 (on a scale of 0 being not vulnerable to 1 being extremely vulnerable to climate change). In addition, this species is classified as a "wink out" species. "Wink-out" species are those species with no future climate envelope. No projected suitable climate areas exist for the species to persist in the future. The known individuals of *C. viridiflora* occur in a narrow range from Koloa to ʻŌpaeʻula along the Koʻolau summit, with only five individuals found as far south as Schofield Barracks East Range, and have no alternate habitat available. Therefore, additional management actions may be needed to conserve this taxon into the future, such as identifying suitable microsites where climate change is anticipated to occur more slowly and considering suitable habitat in areas outside of its known range.

New Management Actions:

- Ungulate monitoring and control—*Cyrtandra viridiflora* occurs in three fenced management areas with fencing maintained by the Army's Natural Resources Program-Oʻahu (ANRP): Kōloa, Helemano, and ʻŌpaeʻula (ARNP 2018).
- Nonnative invasive plant monitoring and control—*Psidium cattleianum* (strawberry guava) is controlled at Kōloa (ANRP 2018).
- Rodent predation or herbivory—Goodnature™ A24 rat traps have been found to be more effective than the Victor® snap traps, and are deployed at ʻŌpaeʻula, encompassing the entire management unit. Traps are checked at 4-month intervals (ANRP 2018).
- Slug herbivory—Testing showed that Ferroxx® is a more effective slug control than Sluggo®, and this toxicant is currently used to protect individuals of *Cyrtandra dentata*, a species closely related to *C. viridiflora*, from herbivory by slugs at ʻŌpaeʻula (ANRP 2018). Populations of *C. viridiflora* could benefit from this slug control method if it was implemented directly at populations.
- Captive propagation for genetic storage and reintroduction—Seed collection has occurred for five founders at Helemano, three founders at Kōloa, and four

founders at ʻŌpaeʻula. However some collections are 15 years old and viability may be uncertain for these older collections (ANRP 2018).

Synthesis:
Currently there are 59 to 63 individuals in seven populations of *Cyrtandra viridiflora* in the Koʻolau mountains. A landscape-based assessment of climate change vulnerability for native plants of Hawaiʻi using high resolution climate change projections was made by Fortini *et al.* (2013) and their analysis showed that *C. viridiflora* is extremely vulnerable to the effects of climate change. Almost 5,000 seeds are in storage. Three areas are protected by ungulate fencing.

Stabilizing (interim), downlisting, and delisting objectives were provided in the Recovery Plan for the Oʻahu Plants (USFWS 1998), and have been updated according to the draft revised recovery objective guidelines developed by the Hawaiʻi and Pacific Plants Recovery Coordinating Committee (HPPRCC 2011). The HPPRCC identifies an additional initial objective, the Preventing Extinction Stage, in addition to the Interim Stabilization, Delisting, and Downlisting objectives. Furthermore, life history traits such as breeding system, population size fluctuation or decline, and reproduction type (sexual or vegetative), have been included in the calculation of goals for the number of populations and reproducing individuals for each stage. The goals for each stage remain grouped by life span defined as annual, short-lived perennial (fewer than 10 years), or long-lived perennial.

Cyrtandra viridiflora is a short-lived perennial small shrub. To prevent extinction, which is the first step in recovering the species, the taxon must be managed to control threats (*e.g*., fenced) and have 50 individuals (or the total number of individuals if fewer than 50 exist) from each of three populations represented in *ex situ* (secured off-site, such as a nursery or seed bank) collections. In addition, a minimum of three populations should be documented on Oʻahu where they now occur or occurred historically and each of these populations must be naturally reproducing (*i.e.,* viable seeds, seedlings, saplings) and increasing in number, with a minimum of 50 mature, reproducing individuals per population.

The preventing extinction goals for this species have not been met. There are no populations totaling more than 50 mature reproducing individuals, genetic representation is not complete (Table 1), and not all threats are controlled (Table 2). Therefore, *Cyrtandra viridiflora* meets the definition of Endangered as it remains in danger of extinction throughout its range.

Recommendations for Future Actions:
Other than the new data on this taxon's vulnerability to climate change, we are not aware of any new threats. There is no significant new information regarding the species' biological status since the last 5-year reviews in 2009 and 2013. Thus, the following recommendations for future actions are reiterated for the 5-year review for 2019.

- Surveys and monitoring—Continue to conduct surveys in suitable and historical habitat for additional populations.
- Ungulate monitoring and control—Continue to construct and monitor fenced exclosures to protect individuals from the negative impacts of habitat degradation and browsing by feral pigs.
- Ecosystem-altering invasive plant species control—Control nonnative invasive plant species at all populations.
- Climate change adaptation strategy—Assess the modeled effects of climate change on this species and use to determine future landscape needed for the recovery of the species.
- Herbivory by rats—Implement control methods for rats at all populations.
- Herbivory by slugs—Implement control methods for slugs at all populations.
- Captive propagation for genetic storage and reintroduction—
    - Continue collection and propagation efforts for maintenance of genetic stock and for reintroduction.
    - Continue to assess genetic variability within the extant populations and implement a plan for conserving the species' genetic diversity in *ex situ* and reintroduced populations.
- Reintroduction and translocation—Reintroduce *Cyrtandra viridiflora* by establishing new populations and augmenting existing populations areas protected from known threats.
- Population biology research—Study *Cyrtandra viridiflora* populations with regard to population size and structure, geographical distribution, flowering cycles, pollination vectors, seed dispersal agents, longevity, specific environmental requirements, limiting factors, and threats.
- Alliance and partnership development—Work with the U.S. Army, the Division of Forestry and Wildlife and other land managers to initiate planning and contribute to implementation of ecosystem-level restoration and management to benefit this species.

Table 1. Status and trends of *Cyrtandra viridiflora* from listing through current 5-year review.

Date	No. wild individuals	No. outplanted	Stabilization Criteria identified in Recovery Plan	Stabilization Criteria Completed?
1996 (listing)	<10	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
1998 (recovery plan)	21	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2003 (critical habitat)	52	0	All threats managed in all three populations	No
			Complete genetic storage	No
			Three populations with 50 mature individuals each	No
2009 (5-year review)	69	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
2012 (critical habitat)	75	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially

			Three populations with 50 mature individuals each	No
2013 (5-year review)	70	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Three populations with 50 mature individuals each	No
Date	**No. wild individuals**	**No. outplanted**	***Preventing Extinction Criteria identified by HPPRCC**	***Preventing Extinction Criteria Completed?**
2019 (5-year review)	59–63	0	All threats managed in all three populations	Partially
			Complete genetic storage	Partially
			Reproduction (*i.e.* viable seeds, seedlings) at all three populations	No
			Three populations with 50 mature individuals each	No

* The Preventing Extinction Stage was established in 2011. Prior to 2011, the Interim Stabilization Stage was the first stage towards recovery (now it is the second after Preventing Extinction).

Table 2. Threats to *Cyrtandra viridiflora* and ongoing conservation efforts.

Threat	Listing factor	Current Status	Conservation/ Management Efforts
Ungulate destruction and degradation of habitat	A	Ongoing	Partial, one location ungulate-free
Established ecosystem altering invasive plant species degradation of habitat	A	Ongoing	Partial, management at four locations
Climate change degradation or loss of habitat	A	Ongoing	None
Rodent predation or herbivory	C	Ongoing	Partial, rodent control within one management unit
Slug herbivory	C	Ongoing	Partial, testing and management within one management unit
Competition with established invasive plant species	E	Ongoing	Partial
Stochastic events	E	Ongoing	Partial, management at four locations

References:

See previous 5-year reviews for a full list of references (USFWS 2009, 2013). Only references for new information are provided below.

[ANRP] Army Natural Resources Program-Oʻahu. 2018. 2018 status report for the Mākua and Oʻahu implementation plans. 217 pp.

Fortini, L., J. Price, J. Jacobi, A. Vorsino, J. Burgett, K. Brinck, F. Amidon, S. Miller, S. Gon II, G. Koob, and E. Paxton. 2013. A landscape-based assessment of climate change vulnerability for all native Hawaiian plants. Technical report HCSU-044. Hawaii Cooperative Studies Unit, University of Hawaii at Hilo, Hawaii. 134 pp.

[HPPRCC] Hawaiʻi and Pacific Plants Recovery Coordinating Committee. 2011. Revised recovery objective guidelines. 8 pp.

Lyon Arboretum. 2018. Report on controlled propagation of listed species, as designated under the U.S. Endangered Species Act. Unpublished report submitted to the U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawaii.

[U.S. Army] U.S. Army, Environmental Division. 2018. Report to the U.S. Fish and Wildlife Service for Oʻahu Army Natural Resource Program, Permit: TES-043638, Reporting period January 1, 2018-December 31, 2018. 16 pp.

U.S. Army Garrison Hawai‘i. 2010. Integrated natural resources management plan 2010-2014, Island of O‘ahu. 375 pp.

[USFWS] 2008. Amendment of the biological opinion of the U.S. Fish and Wildlife Service for military training at Mākua Military Reservation (1-2-2005-F-356). 61 pp.

[USFWS] 2012. Endangered and threatened wildlife and plants; Endangered status for 23 species on Oahu and designation of critical habitat for 124 species; final rule. Department of the Interior, Federal Register 77 (181): 57648–57862, September 18, 2012.

[USFWS] 2013. *Cyrtandra viridiflora* 5-year review summary and evaluation. USFWS Pacific Islands Fish and Wildlife Office, Honolulu, HI. *https://ecos.fws.gov/docs/five_year_review/doc4209.pdf.*

[USFWS] 2017. Endangered and threatened wildlife and plants; initiation of 5-year status reviews for 138 species in Hawaii, Oregon, Washington, and California. Federal Register 82(75): 18665–18668, April 20, 2017.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW of *Cyrtandra viridiflora* (haʻiwale)

Pre-1996 DPS listing still considered a listable entity? N/A

Recommendation resulting from the 5-year review:

_____ Delisting
_____ Reclassify from Endangered to Threatened status
_____ Reclassify from Threatened to Endangered status
X No Change in listing status

For **Field Supervisor, Pacific Islands Fish and Wildlife Office**

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